Geophysical Research Abstracts
Vol. 19, EGU2017-11632, 2017
EGU General Assembly 2017

Tectono-magmatic relationships along an obliquely convergent plate boundary: Sumatra, Indonesia.

Valerio Acocella (1) and Olivier Bellier (2)

(1) Università Roma Tre, Dipartimento Scienze, Roma, Italy (acocella@uniroma3.it), (2) Aix Marseille Univ, CNRS, IRD, Coll France, CEREGE, Aix-en-Provence, France

The tectono-magmatic relationships along divergent and orthogonally convergent plate boundaries have been defined in several aspects. However, much less is known along obliquely convergent plate boundaries, where the strain partitioning promotes strike-slip structures along the volcanic arc. Here it is unclear if and, in case, how strike-slip structures may control arc volcanism, in terms of processes, distribution and size. To better define these features, we review the available tectonic, structural and volcanological data on Sumatra (Indonesia), which provides the ideal case study. The Sumatra volcanic arc consists of 48 major active volcanoes. Of these, 46% lie within 10 km from the dextral Great Sumatra Fault (GSF), which carries most of the strike-slip displacement on the overriding plate, whereas 27% of the volcanoes lie at >20 km from the GSF. Considering the volcanoes lying within 10 km from GSF, 76% show some possible structural relation to the GSF, whereas only 28% (7 volcanoes) show a clear structural relation to the GSF, being located in pull-apart or releasing bends between dextral segments. However, these localized areas of extension do not seem to promote the development of magmatic segments, similarly to orthogonally convergent plate boundaries. Many volcanoes lie to the west of the GSF, largely following the shallower portions of the slab, which reaches its average partial melting depth (130±30 km) more westward. There is a preferred volcano alignment and elongation along the N30-N40°E trend, almost parallel to the convergence vector; this trend coincides with the direction of the extensional structures found along the arc. Other volcanoes are elongated parallel to the GSF, possibly resulting from the co- and post-seismic across-arc extension, as observed during the 2004 mega-earthquake. Finally, there is no relationship between the slip rate along GSF and the erupted volumes along the arc: the highest productivity of Toba caldera may be explained by a slab tear.
Overall, these data highlight a limited control of the geometry and kinematics of the GSF on the arc volcanism of Sumatra. This control is mostly confined to the: a) suitable depth for partial melting of the slab; b) structural configuration of the GSF, promoting localized extension. Otherwise, magma may rise far from the GSF, where the direction of the feeder dikes may be controlled by the inter-seismic extension (perpendicular to the convergence vector) or by the arc normal co- and post-seismic extension.